JUL 2 0 2004

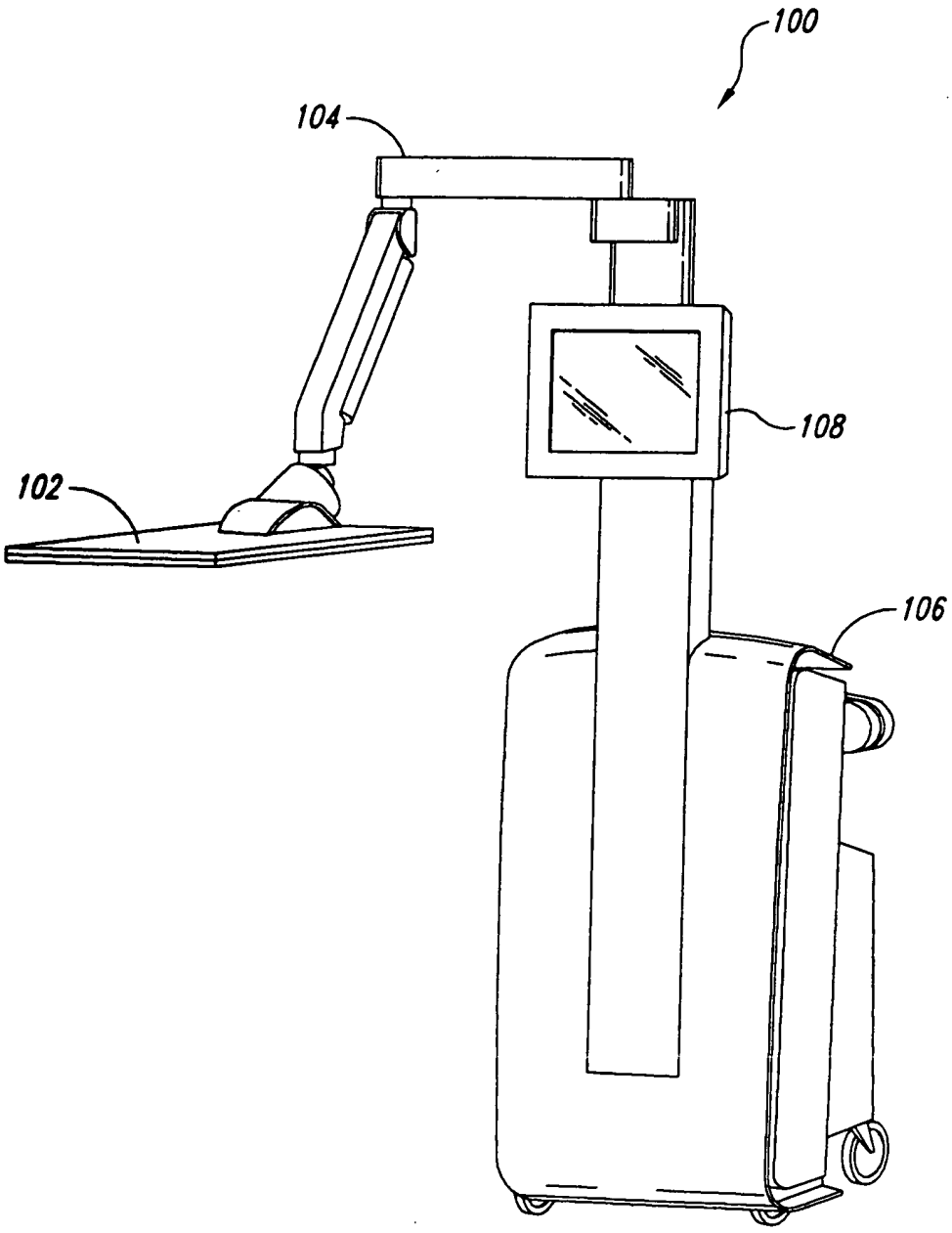

FIG. 1

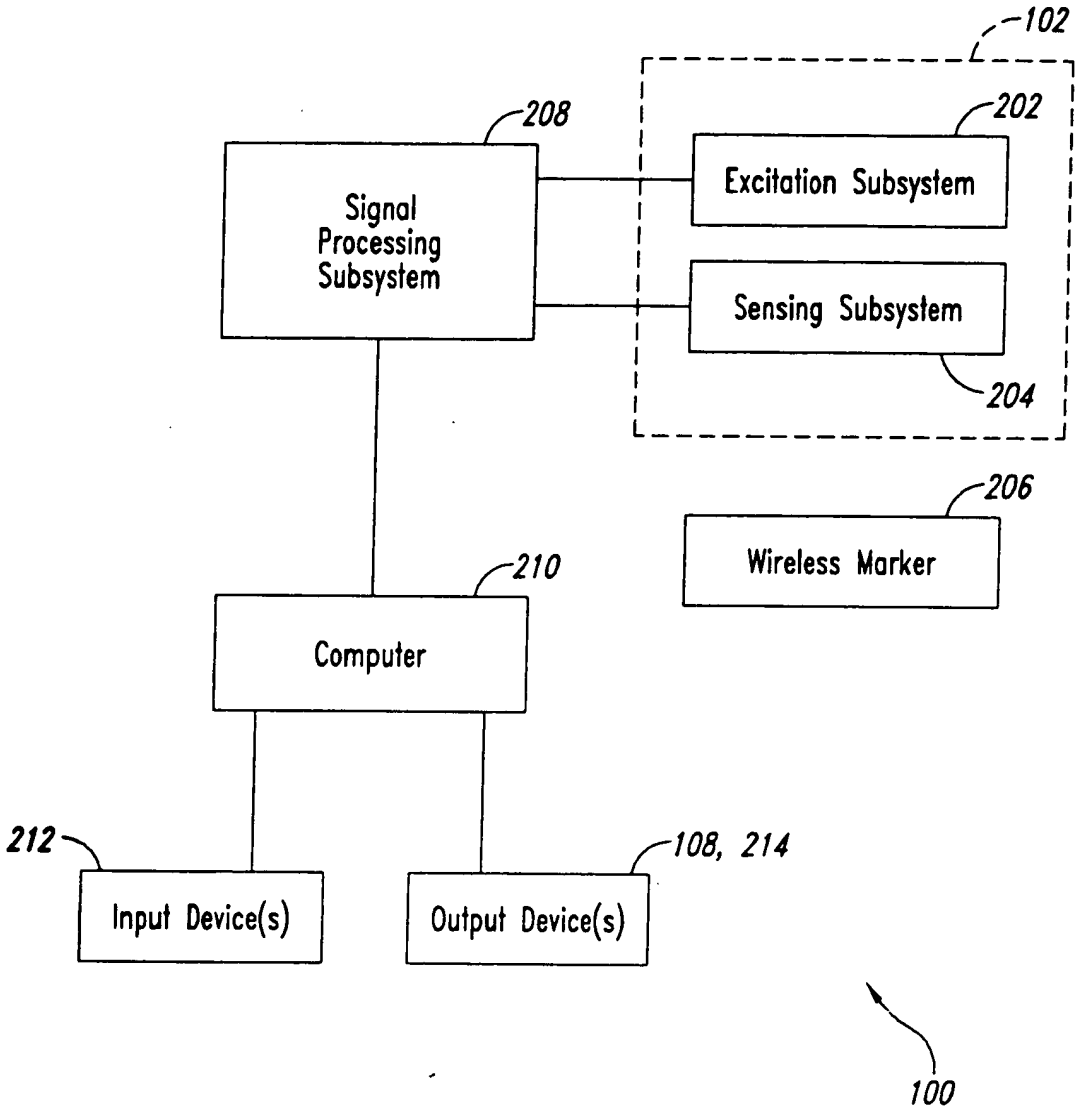
102
208
202
Signal Processing Subsystem
Excitation Subsystem
Sensing Subsystem
204
206
Wireless Marker
210
Computer
212
108, 214
Input Device(s)
Output Device(s)
100

FIG. 2

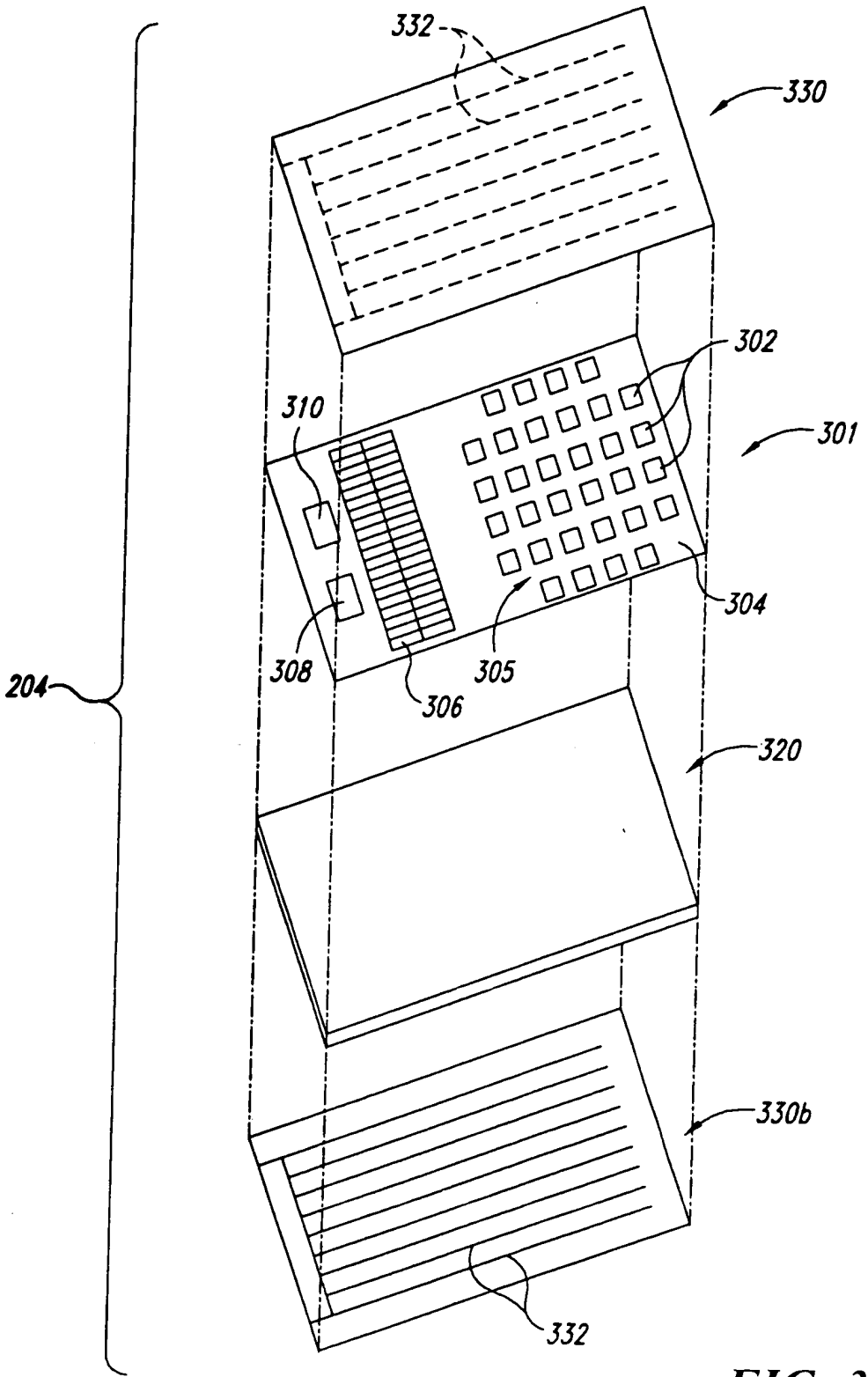

FIG. 3A

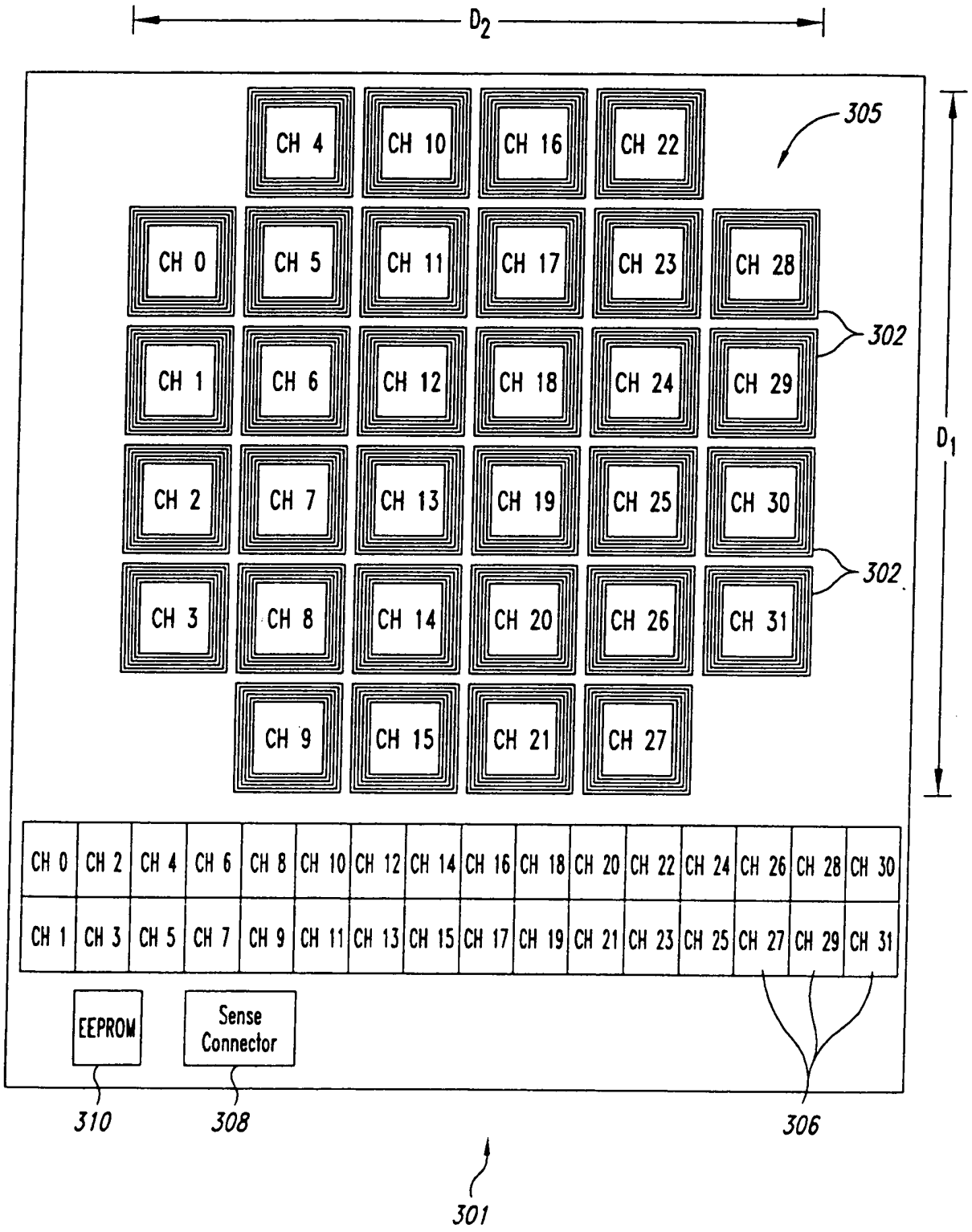
D2
CH 4
CH 10
CH 16
CH 22
305
CH 0
CH 5
CH 11
CH 17
CH 23
CH 28
302
CH 1
CH 6
CH 12
CH 18
CH 24
CH 29
D1
CH 2
CH 7
CH 13
CH 19
CH 25
CH 30
302
CH 3
CH 8
CH 14
CH 20
CH 26
CH 31
CH 9
CH 15
CH 21
CH 27
CH 0 CH 2 CH 4 CH 6 CH 8 CH 10 CH 12 CH 14 CH 16 CH 18 CH 20 CH 22 CH 24 CH 26 CH 28 CH 30
CH 1 CH 3 CH 5 CH 7 CH 9 CH 11 CH 13 CH 15 CH 17 CH 19 CH 21 CH 23 CH 25 CH 27 CH 29 CH 31
EEPROM
Sense Connector
310
308
306
301

FIG. 3B

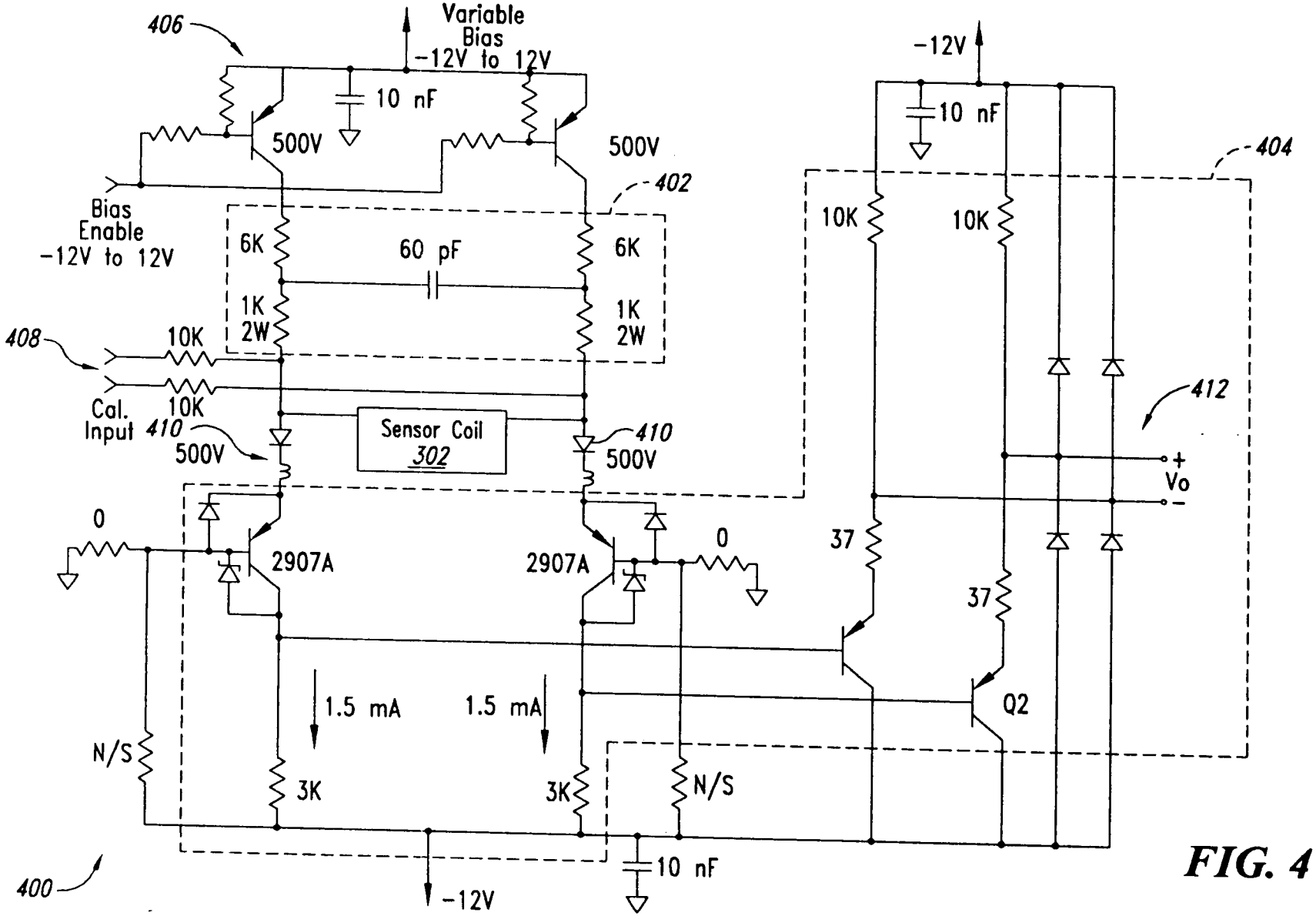
406
Variable
Bias
−12V to 12V
10 nF
500V
500V
402
Bias
Enable
−12V to 12V
6K
60 pF
6K
1K
2W
1K
2W
408
10K
Cal.
Input
10K
410
500V
Sensor Coil
302
410
500V
0
2907A
2907A
0
1.5 mA
1.5 mA
N/S
3K
3K
N/S
10 nF
−12V
400
−12V
10 nF
404
10K
10K
412
+
Vo
−
37
37
Q2

FIG. 4

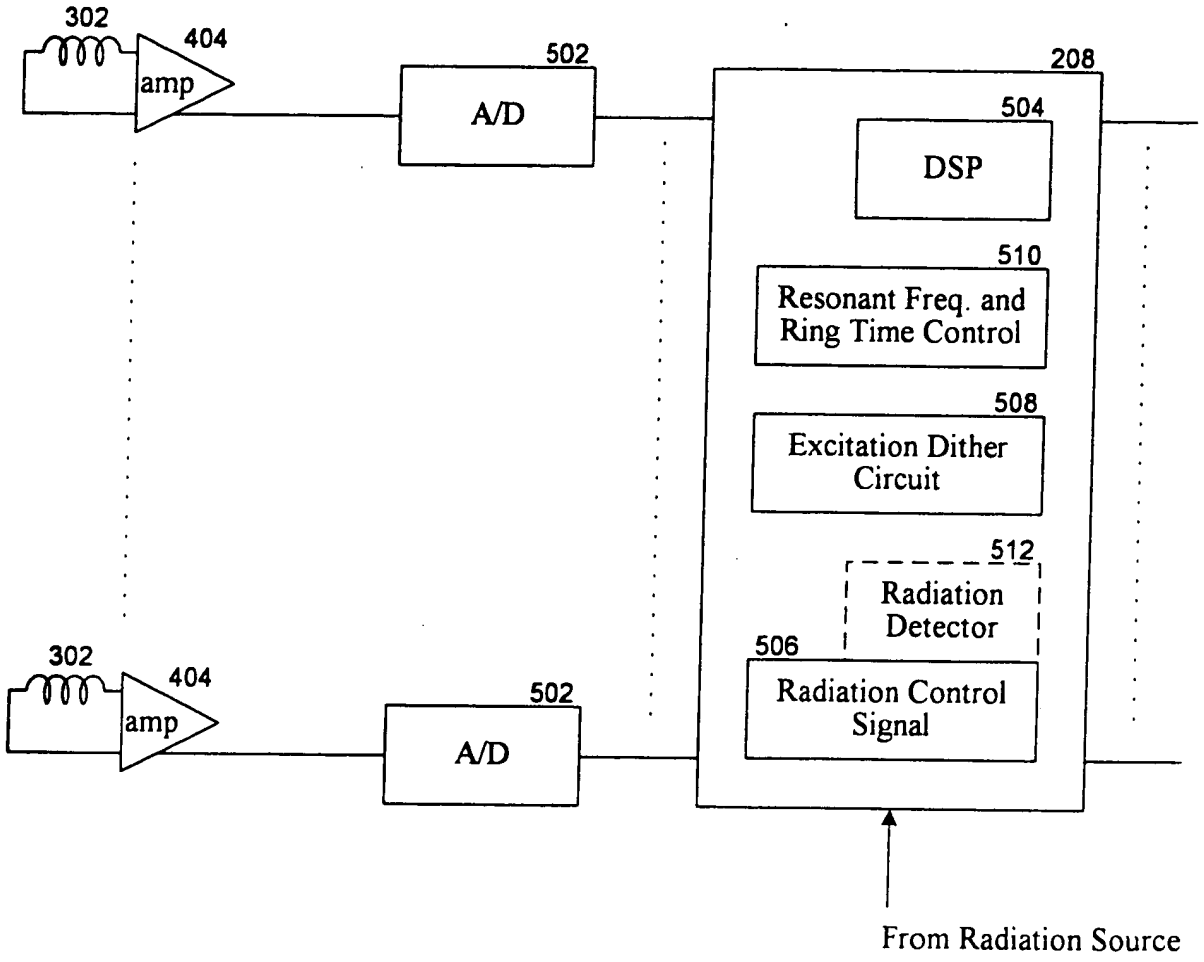
302
404
amp
502
A/D
208
504
DSP
510
Resonant Freq. and Ring Time Control
508
Excitation Dither Circuit
512
Radiation Detector
506
Radiation Control Signal
302
404
amp
502
A/D
From Radiation Source

FIG. 5

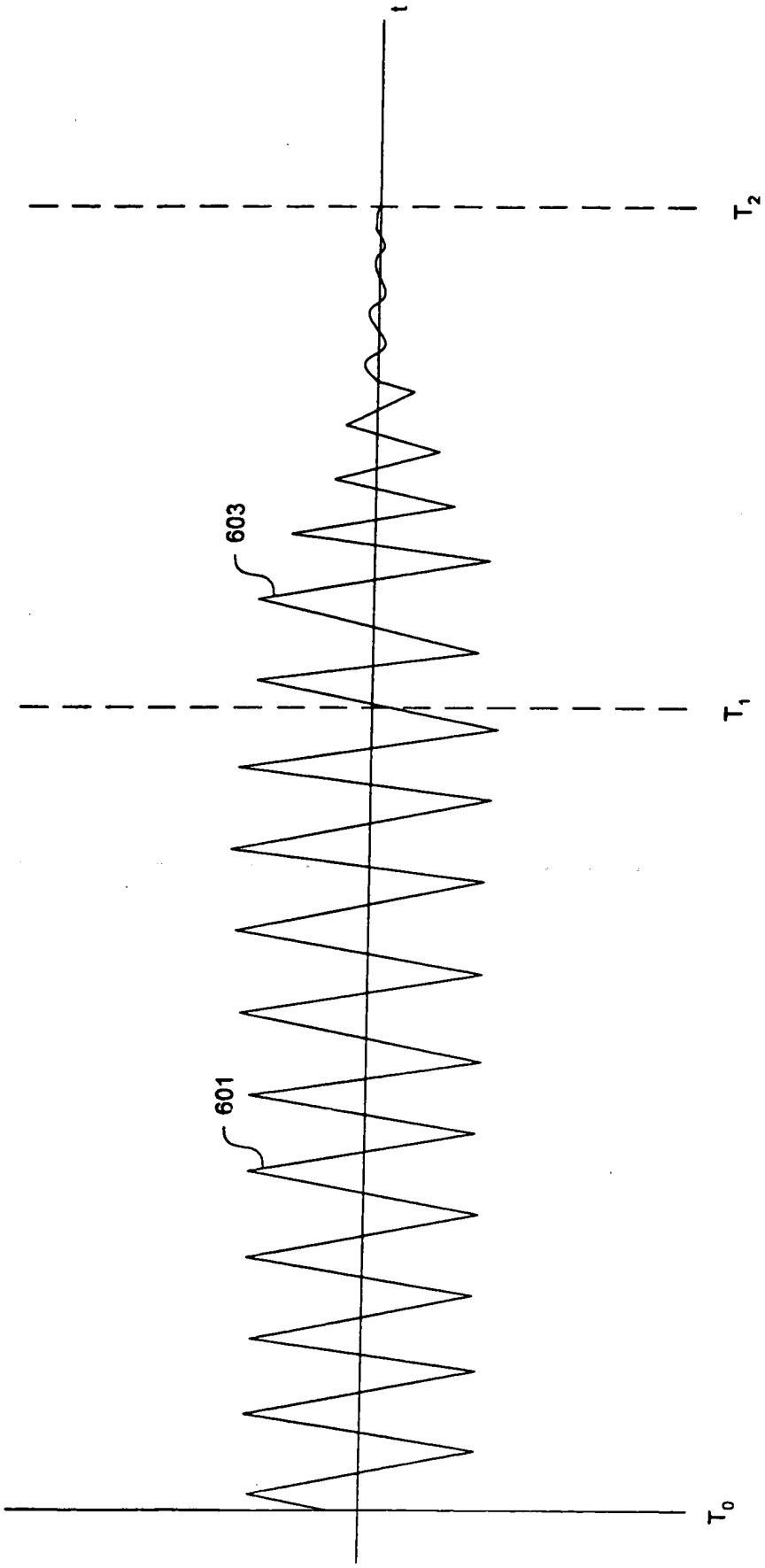

FIG. 6

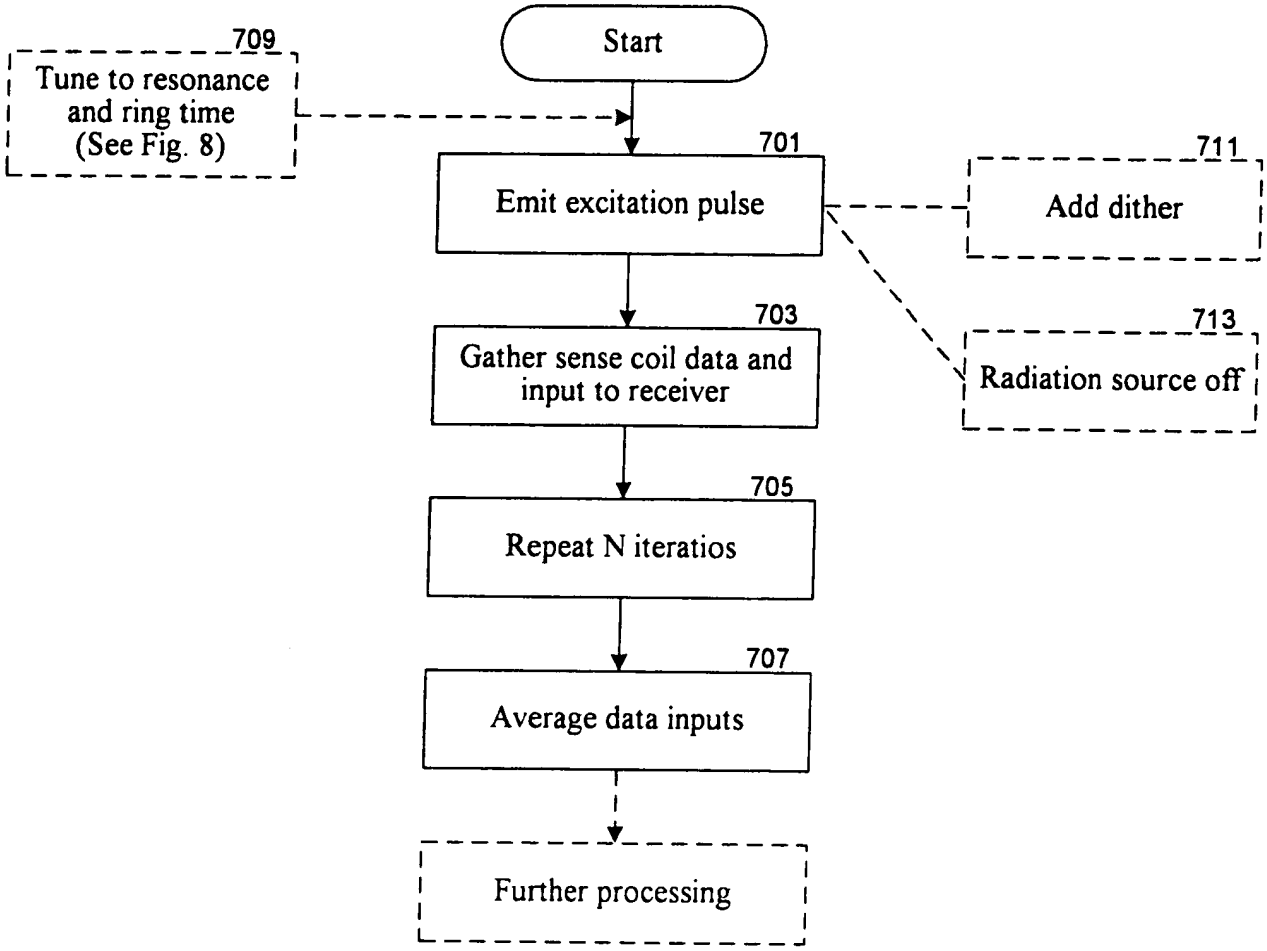
Start
709
Tune to resonance and ring time (See Fig. 8)
701
Emit excitation pulse
711
Add dither
703
Gather sense coil data and input to receiver
713
Radiation source off
705
Repeat N iteratios
707
Average data inputs
Further processing

FIG. 7

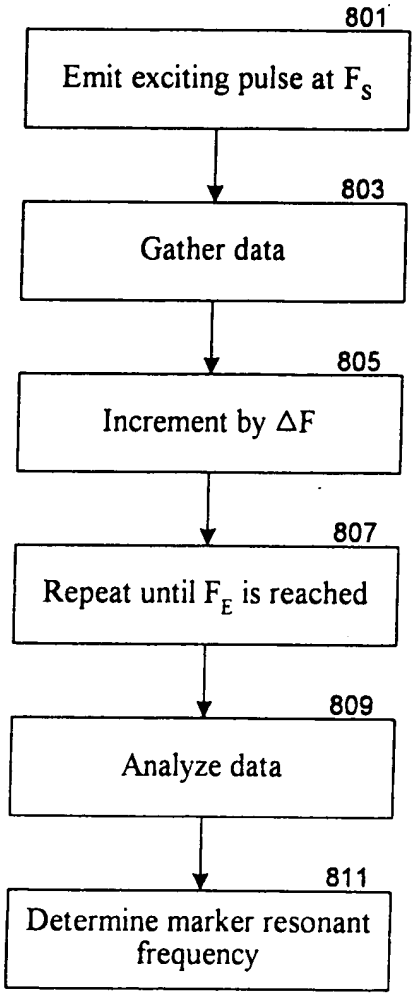
801
Emit exciting pulse at F_S
803
Gather data
805
Increment by ΔF
807
Repeat until F_E is reached
809
Analyze data
811
Determine marker resonant frequency

FIG. 8

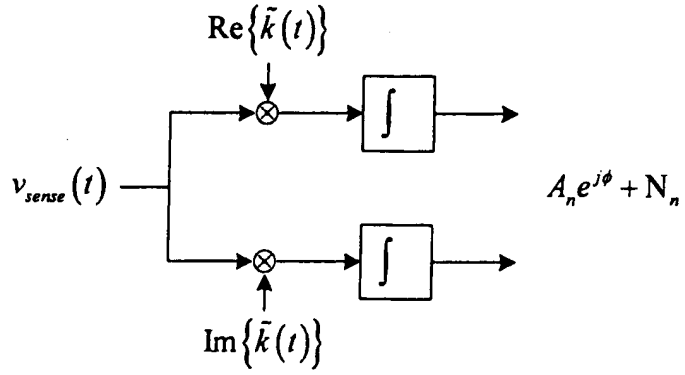

FIG. 9

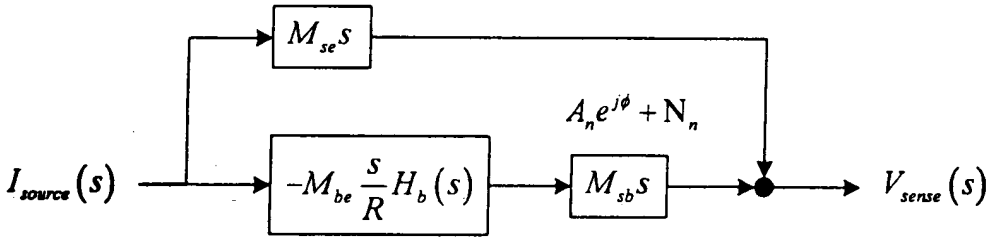

FIG. 10

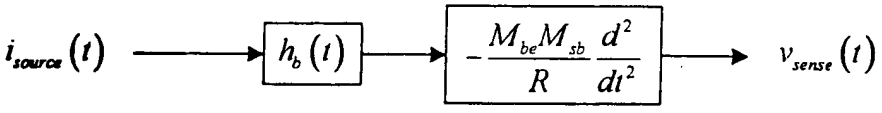

FIG. 11

Sensed Voltage: 100 kHz Beacon, 100 kHz Excitation (arbitrary scale)

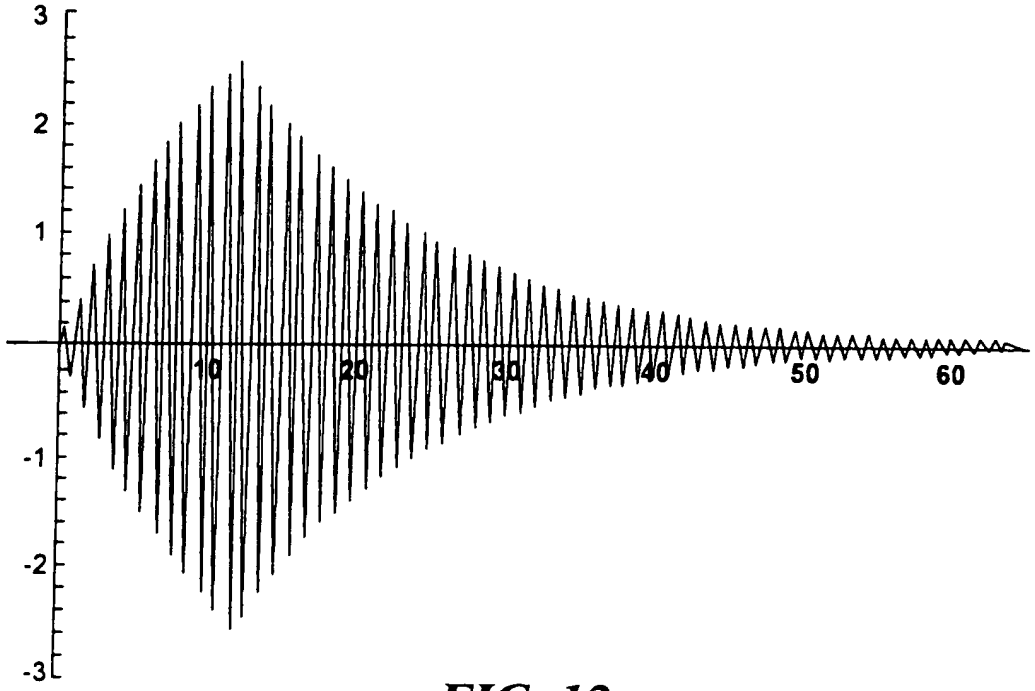

FIG. 12

Sensed Voltage: 100 kHz Beacon, 100 kHz Excitation (arbitrary scale)

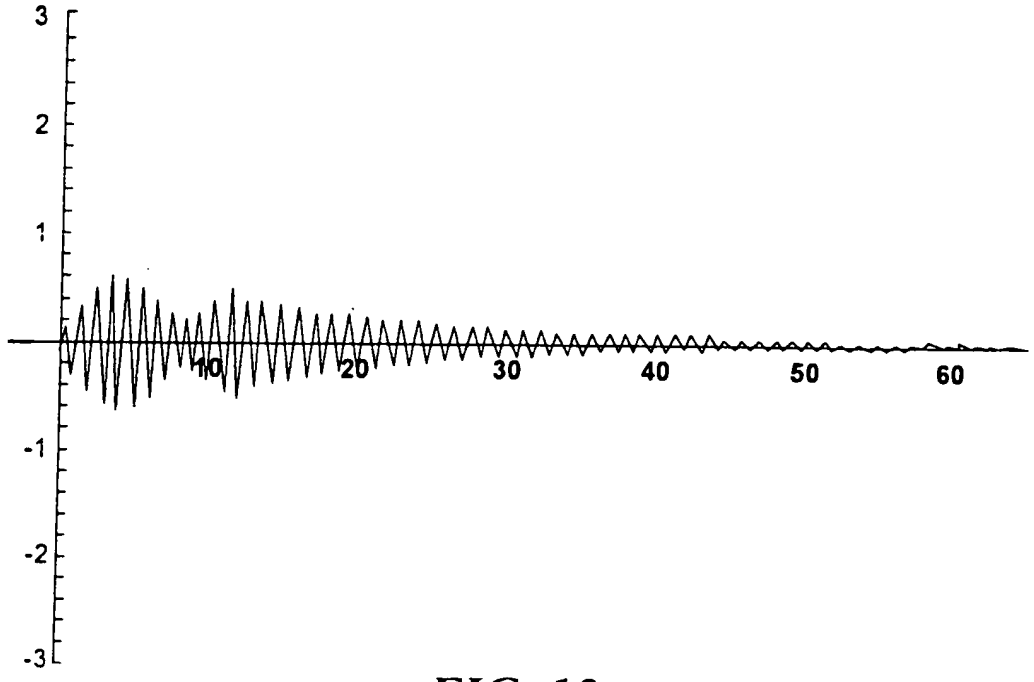

FIG. 13

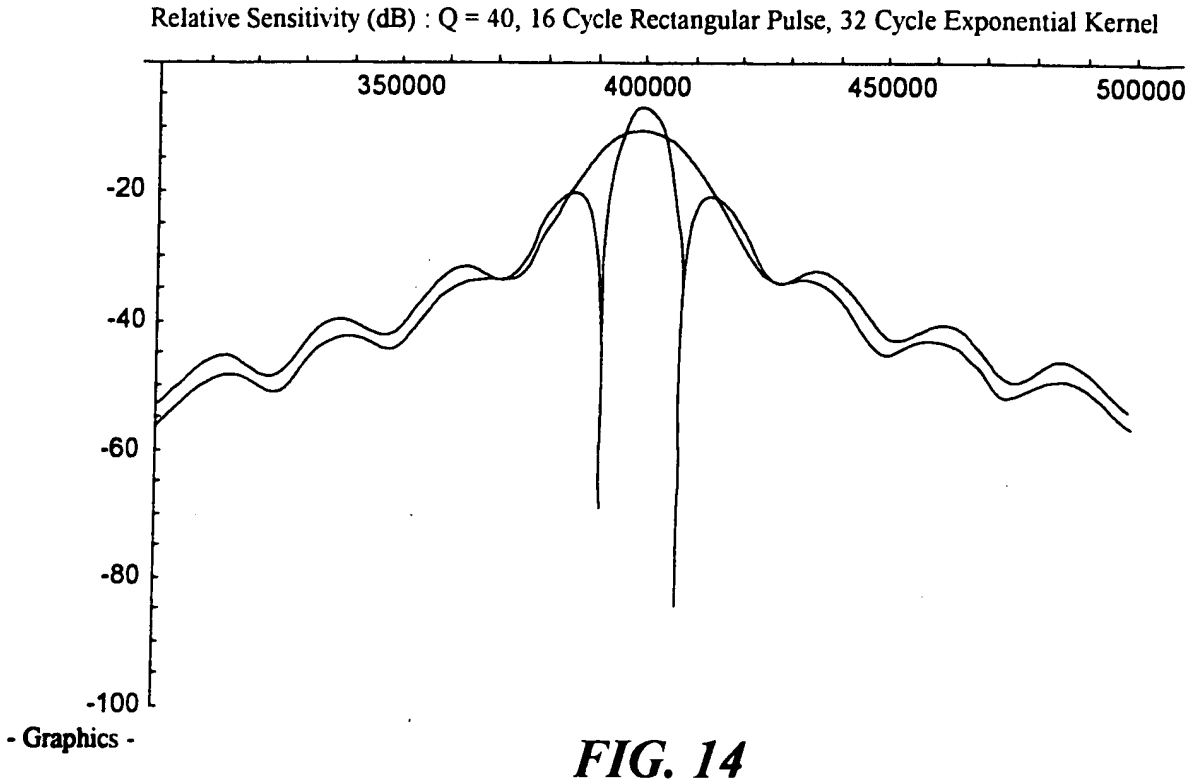
Relative Sensitivity (dB) : Q = 40, 16 Cycle Rectangular Pulse, 32 Cycle Exponential Kernel
350000
400000
450000
500000
-20
-40
-60
-80
-100
- Graphics -

FIG. 14

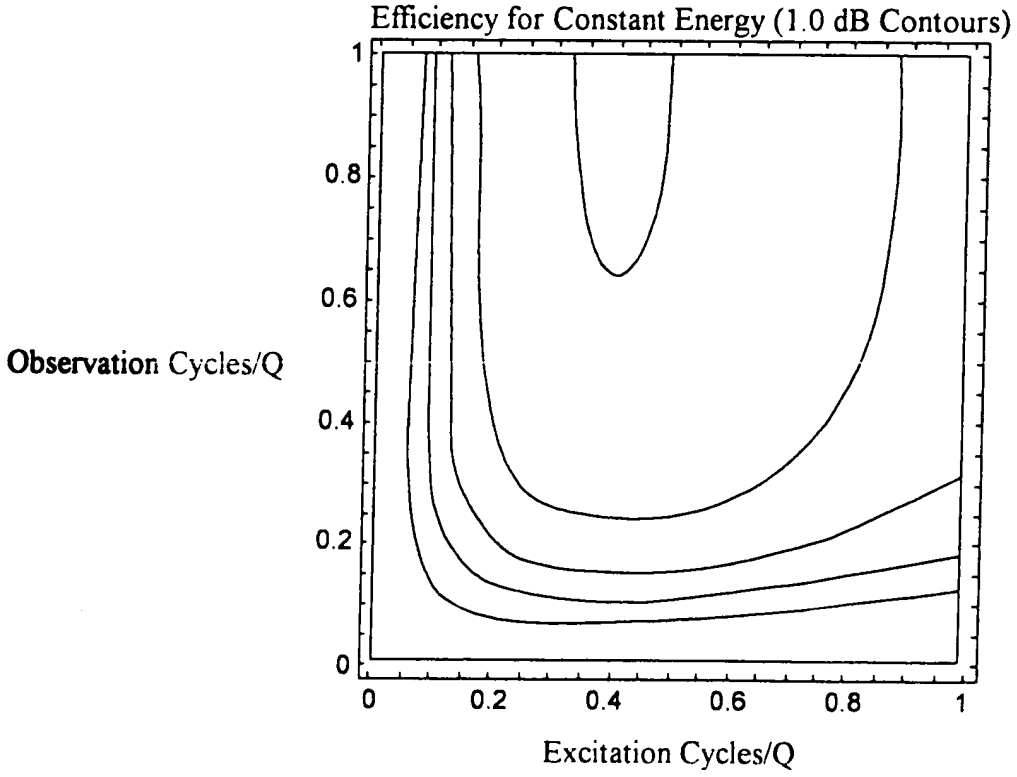
Efficiency for Constant Energy (1.0 dB Contours)
Observation Cycles/Q
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
Excitation Cycles/Q

FIG. 15

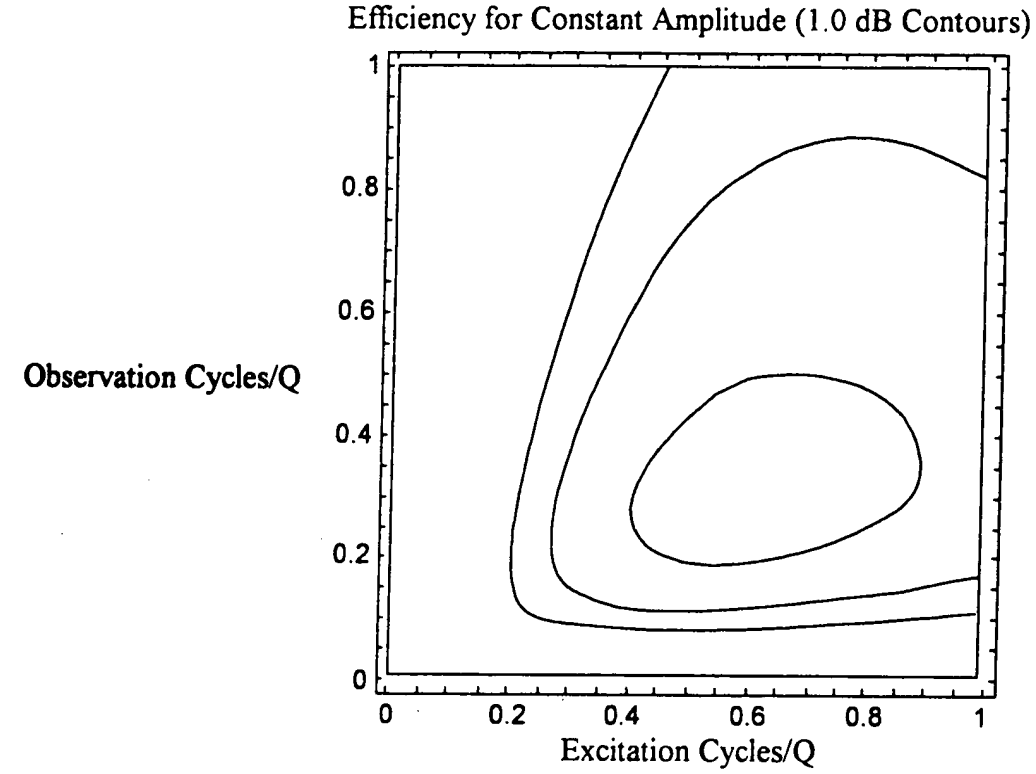
Efficiency for Constant Amplitude (1.0 dB Contours)
Observation Cycles/Q
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
Excitation Cycles/Q

FIG. 16

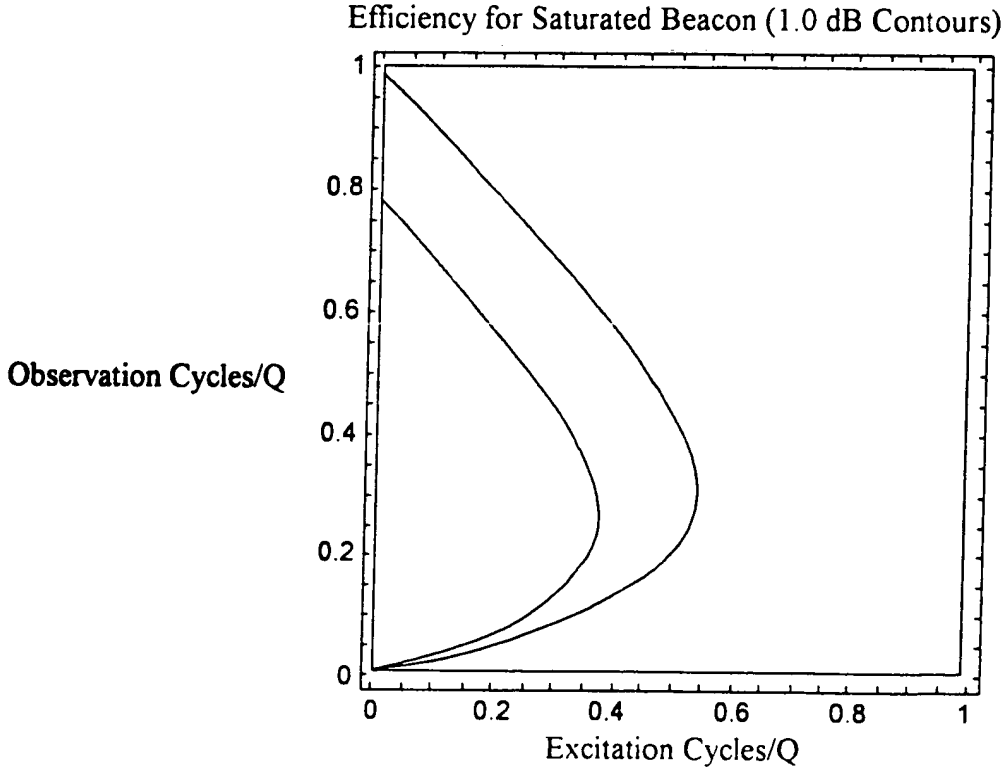
Efficiency for Saturated Beacon (1.0 dB Contours)
Observation Cycles/Q
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
Excitation Cycles/Q

FIG. 17

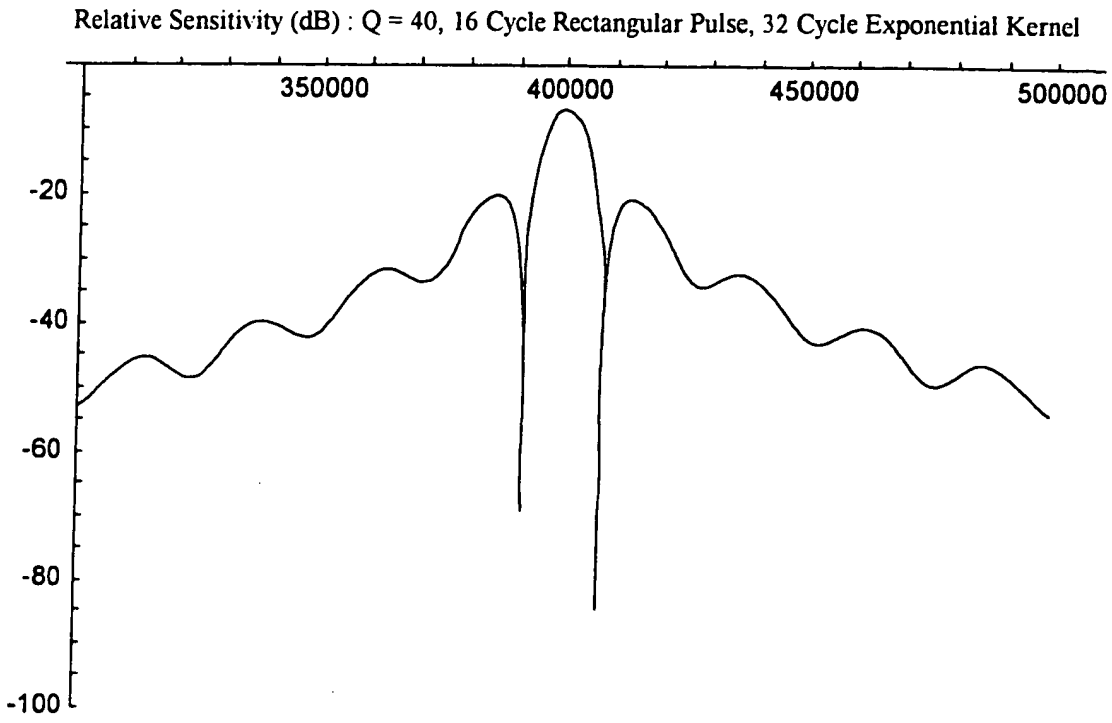
Relative Sensitivity (dB) : Q = 40, 16 Cycle Rectangular Pulse, 32 Cycle Exponential Kernel
350000
400000
450000
500000
-20
-40
-60
-80
-100

FIG. 18

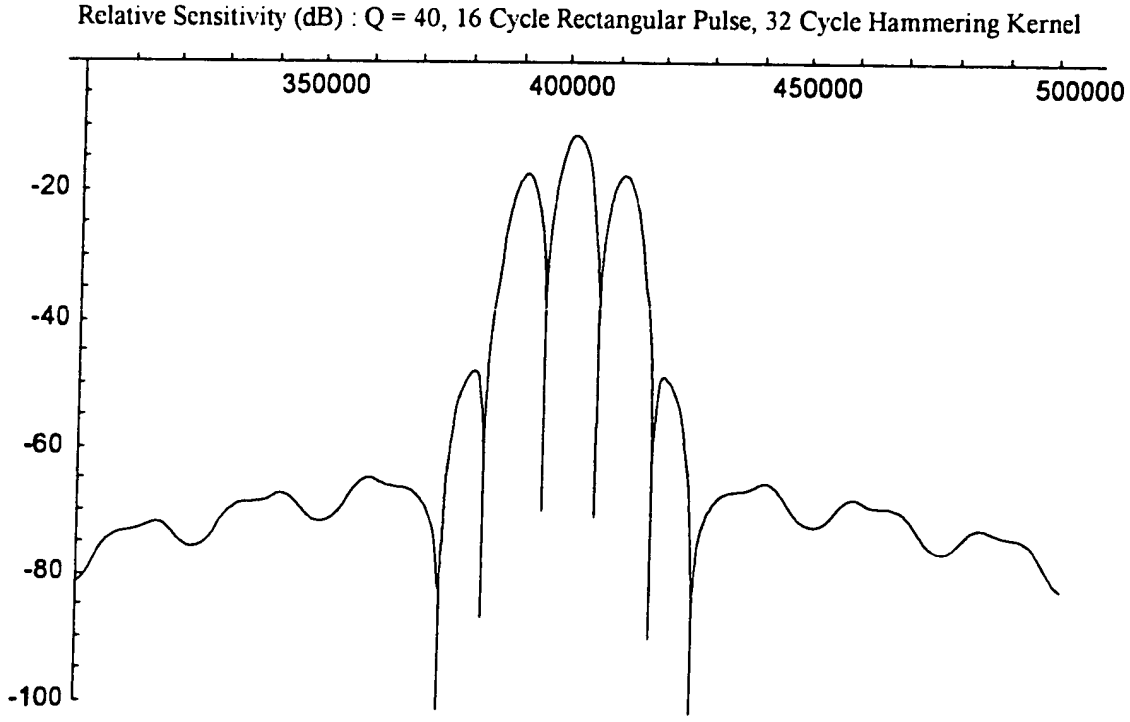
Relative Sensitivity (dB) : Q = 40, 16 Cycle Rectangular Pulse, 32 Cycle Hammering Kernel
350000
400000
450000
500000
-20
-40
-60
-80
-100

FIG. 19

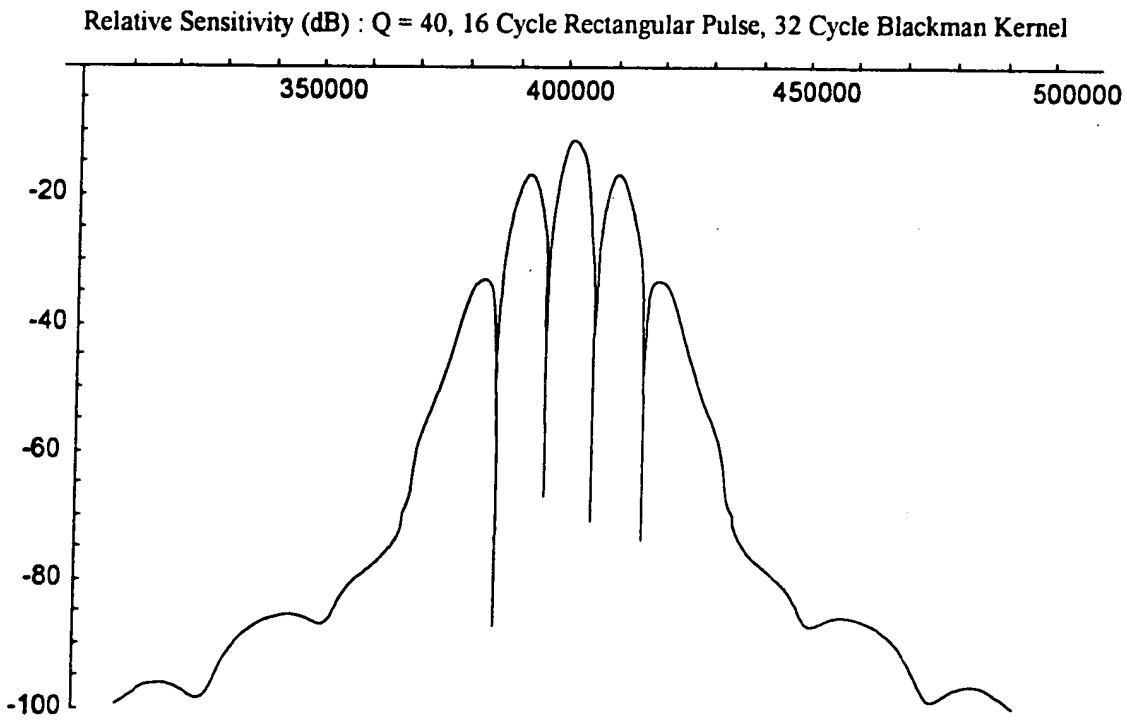
Relative Sensitivity (dB) : Q = 40, 16 Cycle Rectangular Pulse, 32 Cycle Blackman Kernel
350000
400000
450000
500000
-20
-40
-60
-80
-100

FIG. 20